

An Essay

on

Compression of the Brain;

Submitted to the Examination

of the

Revs. J. Andrews, D. D. Mowat;

The Trustees

and Medical Faculty of the

University of Pennsylvania,

For the Degree of Doctor of Medicine.

By, James H. Noel Essex county Virginia

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The intricacy of this disorder, has engaged the attention of many writers from the days of Hippocrates down to the present time: and although some valuable improvements have been made, by modern Surgeons, in the treatment of it; yet it appears still to be imperfectly understood. However, I have selected it as the subject of this essay, not with a view (for I have not the presumption to suppose myself capable) of advancing any thing new, or elucidatory of what has been so ably investigated before; but my object is, by consulting the various authors who have treated of it, comparing their different opinions &c. to become as well acquainted as I can with a dreadful affection to which man is so

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liable, and with which every practitioner must expect frequently to meet.

Compression of the brain may be produced by various causes; such as, Fracture attended with a depressed portion of the cranium, Extravasation, and the Formation of Matter. It may also be caused by Hydrocephalus internus, or by a thickening of bone from disease, as in the lues venerea. The two last mentioned causes will not be taken into consideration; but I shall endeavour to treat of the three first, as occurring from external violence, by describing their symptoms, distinguishing them from other affections apparently similar; and indicating the means most commonly employed in the cure.

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The Symptoms are stupor, drawings, loss of speech and voluntary motion, hemorrhage from the ears and nose, sickness at the stomach succeeded by vomiting. These symptoms, or a part of them at least, when produced by the above mentioned cause, occur immediately after the accident; which circumstance distinguishes this from all the other causes of compression.

In the treatment of Fractures, authors are of different opinions, and none more exceptionable than the justly celebrated Boerhaave. He asserts that it is not only indispensably necessary that every depression of the cranium should be elevated, but that we should operate in seven cases out of ten in simple undepressed fractures: but I believe there are very few of the present day who would not object to this doctrine.

I should suppose that it would be necessary to ^{operate} in no case, whatever, in consequence of a fracture whether depression existed or not, unless there were obvious symptoms of a compressed brain, or unless it was evident from the fractured points irritating the dura mater inflammation might supervene. It is certainly right to raise every depressed piece of bone, if it can be done without perforating instruments or much violence. But Mr. Pott is of opinion that a perforation should be made as a preventative of future mischief. What mischief can it prevent? Not inflammation. If inflammation occur, it is the effect of violence or force done to the head; and certainly the application of instruments cannot diminish this cause but must rather tend

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tend to increase it. If Inflammation exist, Instru-
 -ments cannot remove it. Why may we not
 attempt to prevent it, or if it occurs to resolve
 it, in this part of the system as in any
 other, by copious Bloodletting, purging, blistering
 and a strict antiphlogistic regimen? It is true
 it is on a vital organ, and for that reason
 we should be cautious of precipitately opera-
 -ting. I have seen several instances, and read
 of many others, where a portion of the cran-
 -ium has been depressed by external violence
 (as by the kick of a horse) and the patient
 has done well without its being elevated, and
 even without the aid of a Surgeon. But why
 a depression of the cranium should not at all
 times give symptoms of compression, since its
 cavity in health is completely filled, I am not

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able to account, unless as Doctor Whistler has sup-
posed it probable, that the pressure is made on
the longitudinal sinus. We are told that
sometimes only a portion of the internal tables
of the Skull is depressed. It would be well
to have this fact in view in performing
an operation. But I presume no decisive prog-
nosis could be formed of it, unless the first table
were perforated. This, however, could not be mate-
rial in determining on an operation; for I am
persuaded that when the symptoms of a
compressed brain are distinctly marked, whether
produced by bone or any other cause, we should
never hesitate with regard to perforating the
cranium: The mode of doing which, by the
trepan will hereafter be described. Though I
am inclined to think that the Saw invented by
Mr Key will be found preferable in most cases

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injury from depressed fracture, especially when it would be necessary to apply the Trephine more than once.

Kind of Compression of the brain from Extravasation. This Extravasation of blood or serum may be the effect of ruptured vessels, either between the cranium and dura Mater, the dura & pia Mater, the pia mater & the brain, or in the ventricles of the brain. The symptoms of Extravasation are nearly the same as those occurring from depressed fractures, with which it is often accompanied, and from which it may be distinguished by not occurring immediately & suddenly, but gradually with an interval, generally, between the time of the accident and the time of compression - long or short in proportion to the size of the ruptured vessels.

Extravasation is also often accompanied with concussion or commotions of the brain. When the concussion is slight or of

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short duration, the Patient generally recovers his senses, and after a while, according to the degree of effusion, again relapses into a state of insensibility. But when the Conception is considerable, the brain much disordered, I believe there is no greater deliberation in Surgery than some decisive mark whereby to distinguish it from compression. No part of the profession appears better calculated to embarrass & perplex the judgment of the inexperienced Surgeon than this. In the various authors that I have anxiously consulted on this point, I am sorry to say I have found nothing positive or determinate; they all with one voice acknowledge it dark and obscure. Mr. Hall, by ridiculing the term conception & reasoning analogically, has endeavored to cast some light on it, but its mists be confessed his rays are faint & glimmering.

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he says, "There is every reason to believe congestion
 to be a suffusion into the substance of the brain
 resembling the ecchymosis of a bruised limb, attended
 with symptoms resembling Apoplexy & terminating
 usually in a gradual absorption and slow recovery;
 sometimes in high inflammatory action & sudden
 delirium, in Typhomania: While compression, pro-
 ceeding from extravasation of blood, is plainly
palsy; beginning in stupor, without insensibility
 and ending in hemiplegia & convulsion". He also ob-
 serves in another place, when speaking of congestion
 that the Patient, "when lifted from the ground, is
 found cold, pale, motionless, without pulse, with-
 out sense and is as in a fainting fit; if he
 continues cold & passes his urine & feces involuntari-
 ly, he dies"; and goes on to say if he does well
 this state will be succeeded by high arterial action
 accompanied with delirium, which last are good

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signs. And when speaking of compression from
effusion of blood, says, "The Patient is never insen-
sible unless he is about to expire and rarely
delirious; his pulse never rises but is slow, heavy,
spanning at every fifth stroke; his pupil is
sometimes dilated, one side usually paralysed, the
other often shakes with a sort of tremulous con-
vulsion, which return at regular intervals; he
is attended with a quivering irregular pulse,
cold extremities & insensible evacuations when
he is about to expire!" I cannot say from
experience whether the distinctions drawn by
Mr. Bell ever govt in practice, I fear they
do not; if they do they certainly should have
great influence in directing the mode of prac-
tice. Some authors regret that we have
not an infallible ^{rule} whereby to distinguish what
the purging fluid is!" This is a practical point

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view can be of no importance. When the symptoms of compressed brain are truly marked, as I have before said, the only indication then, is to ascertain the seat of pressure, and endeavour to remove it. The seat of pressure we are commonly led to by an injured scalp or fracture but Extravasation sometimes takes place without any external mark of violence to indicate its seat. Here again we are in the dark. In this situation Mr. Pott, 'tis' a bold operator, has justly confessed, "the only chance of relief is from trepanotomy and an open belly." These together with perfect quietude & low diet should be carried as far as the state of the system will possibly admit. Mr. Cooper observes "If the symptoms are urgent, it certainly might be proper to perforate the cranium in the course of the spinous artery of the dura mater. If no blood should be found under one parietal bone, the operation might be

[Faint, illegible handwriting in a cursive script, likely a historical document or manuscript.]

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here on the other! This Mr. Abernethy's observations
 go to corroborate; he is of opinion that serious
 consequences will seldom result "unless one of
 the large arteries of the dura mater be wound-
 ed." He also mentions "If there be so much blood
 on the dura mater as materially to derange
 the functions of the brain," he believes "the
 bone so situated will not be found to bleed."
 This last circumstance, I presume, would neces-
 sarily depend on the length of time the dura
 mater had been separated from the bone.
 We are directed by Mr. Bell, in difficult cases,
 when there is no external mark to direct, to
 make general pressure over the head, and by
 this, possibly, some tender spot may be discover-
 ed. However if we can, by any means determin-
 ing on the situation of the pulsus, we should
 be immediately operate, in the manner here-
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removed, if the fluid be found on the dura mater, it may generally be removed, the symptoms relieve & the Patient may do well. But if the fluid be between the dura & pia mater the case is extremely hazardous. This may always be suspected, when the dura mater is found to protrude at the perforation, giving a sense of tension to the fingers, and the symptoms not mitigated. Mr Pott here recommends that the dura mater should be punctured; and also the pia mater if necessary, that is, if the cause of pressure be situated within it. But Doctor Whysick is of opinion that this mode of practice is highly improper: in every case where he has seen the dura mater punctured, Inflammation & Death have been the uniform consequences; and therefore he prefers the general remission, particularly copious Bleedings by which treatment he has known several to do well.

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Now come to speak of the third and last proposed cause of Compression of the brain, viz. The Formation of Matter within the Cranium. This is generally the consequence of Inflammation; this Inflammation may be produced by Contusion, concussion or Fracture. In order to understand this rightly Mr. Pott tells it is necessary to know that the vessels of the pericranium, those of the Dura Mater within do all constantly & freely communicate with each other, and upon this freedom of communication depends the health of the parts. Therefore whatever tends to bruise, irritate, or disorder the circulation, must tend to produce inflammation, unless prevented by the means commonly employed for this purpose. The Symptoms, I presume, are generally similar to those indicating inflammation of any other parts, though in a more violent degree; such as, pain in the head as if bound by a cord, restlessness,

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want of sleep, heat & frequent pulse, hot & dry skin, flushed face, inflamed eyes, nausea, vomiting rigors (sign of suppuration) and towards the end convulsion & delirium.

This cause of compression may be distinguished from all other causes of compression, from concussion or commotion by the long interval between the time of the accident & the occurrence of the symptoms. The symptoms of a compressed brain, arising from other causes, or those of concussion appear instantaneously or in a short time after the accident; whereas those arising from the formation of matter from inflammation seldom occur sooner than several days, sometimes several weeks, and in a few cases in several months.

It was the general opinion of former Surgeons, that the matter or pus found on the brain or its membranes, was originally effused or extravasated blood; but this is obviously incorrect, as has been

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satisfactorily proved by Mr. Wolt and others.

Inflammation of the membranes or brain is often the effect of contusion. The first symptoms are, pain in the part which received the blow, which is soon extended over the head, attended with languor or a dejection of spirits, which is soon followed by a nausea and an inclination to vomit, a vertigo or giddiness, a quick & hard pulse, and an incapacity of sleeping at least quietly.

While the patient is in this condition, if the Practitioner were to confine him to a dark & quiet room, bleed copiously (five or six times a day if the state of his system would admit) shave the head and bluster it over, (which last is strongly recommended by Doctr. Physick) and confine him to a strict antiphlogistic regimen; I am confident he would seldom find himself compelled to resort to that disagreeable, dangerous & last alternative the operation. But if this plan be not pursued

the Symptom must go on to increase; the parts injured will become tumefied, soft, tender & puffy; if the Pericranium be examined, it will be found separated from the cranium and the bone of a whitish colour; the wound discharging, instead of pus, bloody serum or a dark coloured ichor. In this situation Mr. Pott would say apply the Trephine without hesitation, remove a portion of bone, and you will find the Brain matter detached from the skull and a quantity of Matter (the cause of compression) situated either upon or within it. This admonition would be just & right; for no doubt the process of suppuration has taken place, Matter has formed and is forming and unless vent is made for its discharge, the Symptoms, to use the words of the learned author every hour after this period are exacerbated, and advance with hasty strides; the headache & Thirst become more intense, the strength decreases, the

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rigors are more frequent and at last convulsive motions, attended in some with delirium, in others with paralysis or comatose stupidity, finish the tragedy.

In the above I have spoken chiefly of that inflammation & suppuration occurring from contusion; but from whatever cause they may proceed the febrile symptoms are not materially different. If the scalp be wounded or cut, though appeared to be doing well, will have its aspect considerably changed upon the recurrence of fever. The edges of the sore will become hard, painful, pale, lose its granulating ^{surface} and discharge only a thin discoloured serum; the Pericranium will be found, also, separated & the bone discoloured. These two last mentioned symptoms appear to have determined Mr. Pott, not only with respect to the propriety of operating, but also with respect to the detached space of the dura mater, & portion of bone to be removed.

If concussion be the cause of Inflammation, the first symptoms generally disappear, and the Patient appears to enjoy health; but in a few days, or probably weeks, according to circumstances, the symptoms of Inflammation succeed, which from this cause above all others should be resolved if possible; for here, generally speaking, it is not only more extensive, but we have no guide whatever to conduct us to the seat of matter when formed.

Inflammation is not infrequently produced by a combination of causes; but let it be produced by what it may the indications are the same that is to resolve it if possible; but if in spite of remedies suppuration succeeds and the compressed brain is evident, a vent must be immediately made, if there be a spot to warrant the application of an Instrument. The mode of doing this I will now endeavour to describe.

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Trephining. This should rank among operations of the first importance in surgery; though safe and simple in the hands of a skilful and experienced operator, yet it is one on which the young & inexperienced cannot too much reflect. It is one that requires judgement & skill, not only to know when it should be performed, which is of the first moment, but also how to perform it. And it is one "that the removal of pressure off the brain, which pressure must also actually occasion dangerous symptoms," can form the only true & vindicable reason for performing it. However, when from the various symptoms given before, it is judged indispensably necessary, it should not be delayed. And the first things to be provided are the Instruments. Here much might be said with respect to the awkwardness & cruelty of those used by the ancients;

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and with respect to the propriety or impropriety of
 many described by the Moderns. But as Practition-
 ers of the present day appear, pretty generally, to
 withgers to show what should be used; and
 as a knowledge of their form, size, figure &c.
 may be best obtained by sensible demonstration, I
 shall proceed to describe the Operations as taught
 in this University.

The Instruments to be
 gotten in readiness are 1st A Scalpel provided with
 a steel edge at the end of the handle; 2nd The
 improved Trephine or two of the same size would
 be better; 3rd An Elevator; 4th A Toothpick; 5th A
 small brush; and 6th A Tenaclum, needles, ligatures
 & springs. The Patient's head if it has not
 been done) should now be shaved, or at least so
 much of the hair should be removed, as necessary.
 He should then be laid on a Table with his head on
 a pillow secured & supported by assistants. The seat
 of injury should now again be examined. And then

is one caution of high importance to the inexperienced Surgeon, that is in examining a tumor he is very liable to be deceived by a sensation of fracture when in fact there is none.

Upon the nature of the case depends the next step; this may be easily ascertained, if the Integuments happen to be lacerated & the Cranium exposed; if not, an Incision should be made with the Scalpel through the Contusion or Tumor down to the bone; guarding, at the same time, against a Fracture, lest the Knife might slip thro' and injure the brain. No part of the Scalp should be removed; a simple or Crucial incision is all that can be necessary. Any hemorrhage must be immediately stopped by pressure or ligature. If a Fracture be found, the Incision should be continued in its direction if it is judged necessary to discover its extent. It has been mentioned by some as difficult to distinguish a Fracture from a Suture; but this may be easily ascertained, first by an anatomical knowledge

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knowledge of the parts; secondly, by a Fracture being always rough; & thirdly, by the Periosteum adhering, firmly to a Suture, but not to a Fracture.

When the Fracture is accompanied with depression it should be raised by the Elevator; if this cannot be done, the judgement of the Operator must determine whether the Saw be preferable to the Trephine; in most of those cases I think it will be found preferable, especially when it is judged necessary to remove a long, narrow or large portion of bone. If the preference be given to the Trephine the Periosteum should be scraped off with the handle of the Scalpel, and the center pin fixed on a sound part of bone, but so as for the circle of the Saw to include a portion of the Fracture. The center pin, being movable, at first should protrude beyond the teeth of the Saw, & be raised gradually as the Perforation is going on, until the Trephine become steady, then it should be finally removed.

The groove should often be examined with the Toothpick,
not

not only to know when it was nearly thro', but also in which ribs to bear the saw. During this time, if there be but one saw, an assistant should be engaged, with the Brush or Towel, in cleaning its teeth. When the saw is found to be nearly through, it would be better for fear of its teeth injuring the dura mater, to break out the piece of bone with the Elevator; the splinters of bone if there be any may also be removed by the same instruments.

Some authors mention the diploe as a guide for knowing when the saw is nearly through, but this should not be relied on; for many parts of the cranium, especially those of old persons have no diploe. After the perforation is made the depressed portion of bone may commonly be raised by introducing one end of the Elevator and bearing on the other. If the depression is accompanied with extravasation it will probably be discharged thro' the perforation.

When there is no fracture, and the operation is performed to relieve pressure from blood, serum or matter it should be conducted in the same manner.

how often the Trephine should be applied, the circumstances of the case and the good sense of the Surgeon can alone determine; It is certainly right to remove so much bone and only so much as will permit the mass of pus to be discharged.

After the removal of bone, if we find the cause of pus situated upon the Dura Mater, we conclude our task if it is favourable; it may be discharged thro' the perforation, and the symptoms of a compressed brain relieved. But on the contrary, if the cause be situated under ~~the~~ within the Dura Mater, we must halt, reflect & proceed no farther; but rather try what virtue there is in general remidies, such as most copious bloodletting, lavatives, blisters on diet, rest &c. Nursing is, also, recommended by Doctor Rush in difficult cases, the good effects of which he has witnessed in the Pennsylvania Hospital. It when the symptoms are extremely urgent, the Dura Mater much protruded, its colour altered &c. I am disposed to think, it would be well as the last
alternative

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alternative, to puncture it with the point of a lancet.
but when reduced to this extremity, the Patient is truly
in jeopardy; and we may now with propriety say
*hic corpus est de his, & quibus non evadunt aliqui
viri inter Dei*."

Much has been said with respect to operating on
particular parts of the cranium; but I believe sur-
geons of the present day seldom hesitate to operate
on any part that may require it. However in
operating on bone of irregular thickness the Surgeon
should be particular in frequently examining the
wound; And when the Saw has entered at one part
Boeth Physick, in order to defend the Dura Mater, has
introduced, with advantage, a small spatula.

Hemorrhage from any of the vessels may generally
be checked by pressing with the finger for some time
or introducing a small bit of lint, or when the artery
is embedded in bone a small cedar plug as recom-
mended by Boeth Physick.

With regard to dressing the wound after the
operation

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operation most Practitioners recommend the scalp
 of the scalp to be laid down, and a little soft lint
 covered with a simple ointment to be applied; but
 Doctor Whistler objects the use of lint for this good
 reason, that the lint generally becomes encrusted
 with blood or some fluid & is very difficult to
 remove without much irritating the parts; and
 therefore he prefers a soft poultice which can easily
 be removed & renewed as occasion may require.

The dressings are best retained by a common night
 cap.

After the wound is dressed the Practitioner's attention should
 now be turned particularly to guard against Inflammation
 and Symptomatic fever. In order to effect this, his
 patient should be committed to a dark & quiet room;
 confined to a low diet, and his bowels kept regular
 by gentle laxatives. But if symptoms of fever, unfor-
 tunately, supervene, we must immediately fly to the
lancet as our chief aid; in no case probably is
 blood-letting so copiously required. This together with
 blisters

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blaters and the antiphlogistic plan must be strictly adhered to.

Thus have I treated the subject; and altho' I have spoken of external violence as the remote cause, yet compression, no doubt, frequently occurs from other causes; and often appears in the form of the most formidable diseases in the Nosologic Catalogue. Indeed such is the sympathy existing between this organ (the brain) and the other parts of the system that in no disease should it escape the attention of the Practitioner. Its functions &c. are, however, at present so imperfectly known, that it would be presumption in me to say any thing farther. I shall therefore conclude hoping, with Doctor Cullen, "Disceat!" But before I conclude I humbly tender my cordial Thanks to the Medical Profession, collectively & individually, for the much information I have obtained from their lectures; and that they may long live to occupy the chairs which they now so ably fill is the fervent wish of their devoted Servant. -

[Faint, mostly illegible handwriting on aged paper, possibly a letter or manuscript page. The text is obscured by a large, irregular piece of torn paper or tape covering the upper right portion of the page.]

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